Best
Available
Copy

A SEARCH FOR FAINT BLUE STARS

XXXIII. PROPER MOTIONS FOR 148 PHL STARS
XXXIV. PROPER MOTIONS FOR 24 BLUE STARS IN ORION

64-5

by WILLEM J. LUYTEN
and HELEN S. HUGHES

Report on Contract Nonr 1892 (00)

THE OBSERVATORY
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA

A SEARCH FOR FAINT BLUE STARS.

XXXIII. PROPER MOTIONS FOR 148 PHL STARS.

by Willem J. Luyten and Helen S. Hughes

In Tonantzintla Bulletin No. 20 Haro and Luyten have published data on 8746 faint blue stars found on Palomar Schmidt plates in the general neighborhood of the South Galactic Pole. In order to derive some information on the luminosities of these stars we have begun a program of measuring proper motions for all those stars for which sufficient old plate material is available. This consists of two kinds, generally

1. the published measures in the Astrographic Catalogue for those stars brighter than 12.5 - 13.0 pg,
2. the invaluable plate collection of the Harvard Observatory for stars brighter than about 16.0 pg — in the present instance mainly plates taken with the 24-inch Bruce refractor.

We are greatly indebted to D.H. Menzel director of the Harvard College Observatory for making the latter material available to us.

For each star from 6 to 8 comparison stars of roughly the same brightness were selected except that for those stars contained in the Astrographic Catalogue we had, perforce, to use only stars included in the catalogue. In general the oldest Harvard and Astrographic plates go back to around 1900 except for the Hyderabad and Cordoba and some Perth zones which are much more recent. For the newest epochs we used exclusively the duplicate negatives on glass of the Palomar Survey. All measures were reduced with linear formulae only and the proper motions and their estimated mean errors were derived by plotting the data and graphically drawing the best fitting straight line through them.

The final results are shown in the table which is arranged in the same way as the corresponding table in paper XXIX. The first section gives data for the 54 stars also listed in the Astrographic Catalogue, the second gives the data for the 94 stars measured only on old Harvard plates. In both sections the first two columns give the PHL number and any other previous designation available. In the first section these are double numbers for stars in the BD or Co D, (such as -24: 731) and triple numbers for stars in the Astrographic Catalogue only (such as -17: 779: 898) both will serve as complete identification. The next four columns give the equatorial position for 1950 and the galactic coordinates; the next three the estimated photographic magnitude and the two colors derived by Haro and Luyten, the first of these being close to B-V and the second approximating about 2/3 of U-B in the Johnson-Morgan system. The four colomns following give the total number of plates used, the maximum difference in epoch (in years), the number of comparison stars used, and their mean photographic magnitude. This latter quantity was estimated differentially to the published photographic magnitude of the PHL stars such that when accurate photoelectric magnitudes become available for these the corresponding values for the comparison stars can be easily corrected. The next two columns show the corrections used to convert the relative motions measured into absolute values, these corrections having been derived according to the precepts given in paper XVII. The final two columns give the resulting absolute values of the proper motions in right ascension and declination and their respective estimated mean errors. In each of the two sections we have followed the consecutive numbering of the PHL catalogue, numbers from 1-1569 having been assigned to the extremely blue stars, 1570-4498 to the ordinary bluish looking stars and 4499-8746 to the not-so-blue stars. Stars marked with an asterisk have some further information listed for them in the notes. Considering the original division made into three groups, according to color, it is not surprising that most stars with motions large enough to suggest they are ordinary white dwarfs fall in the first group (PHL 28, 145, 459, 838, 984, and 1062). The only exception is PHL 8686 which did not appear to have a strong ultraviolet on the PHL plates but this might well be due to differential extinction since it occurs on the southern most group of plates. Stars PHL 35 and 3802 have motions of a size as to suggest that they are either white dwarfs of very low tangential velocity or are stars intermediate in luminosity between the main sequence and the white dwarfs. Star PHL 25 would appear to have an absolute magnitude around +6 to +8 similar to that of the U Geminorum stars; it should be tested

PHL	BD, Co D, or Carte du Ciel	RA (1950) Dec	l_{II}	b_{II}	m_{pg}	B-V	U-B
25*	-17: 779: 898	$21^h 29^m.2$ -17°32'	34°	-43°	11.8	-2	-6
159	+ 2: 2199: 193	46.2 + 1 43	59	-37	10.8	-1	-4
346	-19: 1146: 374	22 34.9 -18 56	41	-58	11.7	-2	-4
375	+ 1: 2219: 145	39.2 + 0 57	70	-48	11.9	-1	-3
460	-23: 2044: 447	23 17.0 -22 36	41	-69	11.5	-2	-4
718*	-12: 859: 79	0 08.9 -11 46	90	-72	var.	0	-5
797	- 4: 1409: 63	17.9 - 4 00	104	-66	13.0	-1	-3
1000	-27: 3466: 10	1 06.2 -27 10	210	-86	12.5	-2	-4
1003	-26: 3008: 423	09.8 -26 31	204	-85	12.0	-2	-4
1079	+ 4: 2595: 159	35.8 + 3 23	145	-57	12.4	-2	-5
1126	-24: 731	41.4 -24 20	201	-78	10.5	-2	-4
1344	-20: 477	2 30.7 -20 35	202	-66	10.0	-1	-3
1641*	- 3: 4460: 128	21 33.8 - 3 20	52	-38	9.2	0	-2
1745	-20: 428: 80479	44.2 -20 22	32	-47	12.0	-1	-1
2018	-24: 2917: 30	22 36.2 -24 09	32	-60	11.7	-1	-2
2362	-26: 16667	23 27.2 -26 18	32	-72	10.0	-1	-1
2768	-14: 28	0 12.0 -13 45	89	-74	11.5	0	-2
2908	+15: 332: 97	41.2 +15 13	120	-47	12.2	-1	-2
3086	- 3: 123	51.8 - 2 56	125	-66	10.0	-1	-2
3275	- 5: 1364: 28	1 00.3 - 5 00	130	-67	12.0	-1	-1
3285	- 4: 133	00.8 - 4 04	130	-66	10.5	-1	-2
3802*	-27: 3926: 170	46.4 -26 52	214	-77	12.2	0	-3
4748	-13: 2447: 292	21 38.4 -13 28	40	-44	12.0	0	0
4980	- 8: 458: 9	50.7 - 8 40	48	-44	12.7	0	-1
5192	- 8: 551: 53	22 25.8 - 8 00	56	-51	11.5	+1	-1
5382	-25: 3924: 159	36.9 -25 12	30	-60	12.3	0	-1
5437	-20: 1416: 513	41.8 -20 10	40	-60	12.5	0	-1
5754	-25: 3011: 342	23 21.2 -25 17	34	-70	12.0	0	-1
5882	- 9: 3871: 86	26.9 - 8 48	73	-63	12.0	0	0
5885	- 9: 6201	27.1 - 9 17	72	-64	10.1	-1	-1
5901	-27: 3880: 750	27.6 -27 00	30	-72	12.5	+1	-1
5950	-21: 6438	31.0 -21 02	48	-71	11.0	0	-1
5980	-27: 3849: 960	34.5 -26 31	32	-73	12.0	0	-1
5992	-24: 17776	35.6 -24 10	40	-73	10.0	0	0
6029	-31: 19399	40.0 -31 24	14	-74	9.8	+1	-1
6245	- 9: 488: 106	0 01.7 - 8 34	90	-68	11.4	+1	-1
6276	-13: 897: 34	03.8 -13 04	84	-72	11.0	0	-1
6428	-14: 27	11.8 -13 36	89	-74	10.5	0	0
6539	- 1: 595: 75	40.4 - 1 12	118	-64	12.0	0	0
6605*	-32: 581: 153	45.3 -31 40	312	-86	12.0	0	-1
6709	+10: 7: 135	47.3 +10 00	122	-53	11.5	0	0
6783	-12: 982: 64	49.7 -10 56	124	-74	12.3	0	-1
6807	- 3: 1357: 133	50.4 - 3 07	124	-66	12.5	0	0
6918	-31: 5053: 931	54.0 -31 28	288	-86	12.0	0	-1
6984	-32: 395	57.0 -32 14	284	-85	10.0	0	0
7001	+10: 8: 23	57.3 +10 40	126	-52	10.0	0	0
7104*	-19: 168	1 01.6 -18 51	142	-81	9.3	0	0
7147	-20: 1172: 741	03.4 -20 05	148	-82	11.5	0	0
7202	-22: 2108: 824	08.8 -21 55	163	-83	12.5	0	-1
8374	-21: 1764: 877	2 32.4 -21 20	204	-66	12.5	0	0
8647	-24: 2090: 731	3 20.8 -24 17	216	-56	11.0	0	0
8667	- 7: 600: 14	23.8 - 7 10	191	-48	12.2	0	0
8677*	-21: 630	25.5 -21 32	212	-54	9.4	0	0
8704*	-24: 1715	30.5 -23 48	217	-54	9.7	0	0

PHL	n_{pl}	∠E	n_*	m_*	Correction to relative motion μ_α	μ_δ	Absolute μ_α	μ_δ
25*	6	57	7	12.4	+''006	-''007	+''010 ±''012	-''059 ±''015
159	4	45	12	11.8	+.006	-.007	+.003 ±.009	-.014 ±.013
346	4	37	6	12.0	+.010	-.008	+.022 ±.011	-.015 ±.008
375	4	56	8	12.4	+.007	-.007	+.001 ±.004	-.013 ±.004
460	4	35	10	11.3	+.015	-.011	-.018 ±.017	+.009 ±.017
718*	6	53	5	12.9	+.010	-.007	+.010 ±.004	+.012 ±.006
797	6	58	12	12.5	+.011	-.008	-.006 ±.006	-.003 ±.003
1000	4	44	6	12.4	+.014	-.005	+.005 ±.011	+.009 ±.010
1003	4	41	7	11.6	+.017	-.006	+.021 ±.010	+.001 ±.010
1079	3	39	12	11.8	+.013	-.009	-.017 ±.014	-.023 ±.008
1126	6	55	10	10.4	+.020	-.007	+.103 ±.005	-.007 ±.004
1344	6	52	8	12.1	+.013	-.004	+.041 ±.008	+.018 ±.007
1641	7	59	8	12.9	+.005	-.006	-.019 ±.012	-.013 ±.004
1745	7	57	10	13.3	+.006	-.006	+.010 ±.004	-.005 ±.004
2018	6	53	8	12.8	+.009	-.007	+.012 ±.003	-.017 ±.005
2362	6	56	7	12.2	+.013	-.008	+.018 ±.005	-.010 ±.006
2768	6	53	8	11.7	-.014	-.009	+.004 ±.005	-.001 ±.005
2908	6	57	5	12.5	-.008	+.008	+.038 ±.003	-.036 ±.004
3086	4	61	9	10.8	+.017	-.010	+.030 ±.012	-.031 ±.010
3275	4	62	8	11.0	+.017	-.010	+.007 ±.006	-.004 ±.010
3285	4	61	9	11.0	+.017	-.010	+.009 ±.009	-.024 ±.011
3802*	8	55	10	12.6	+.013	-.004	+.085 ±.004	-.035 ±.004
4748	4	48	9	11.8	+.007	-.008	-.001 ±.012	-.034 ±.010
4980	6	62	7	13.5	+.005	-.005	-.010 ±.009	-.014 ±.005
5192	4	62	9	12.1	-.008	-.008	+.034 ±.009	+.005 ±.007
5382	6	49	9	12.4	+.010	-.007	+.064 ±.004	-.023 ±.004
5437	4	35	9	11.8	+.012	-.009	+.035 ±.007	-.020 ±.008
5754	6	57	9	12.4	+.012	-.007	-.015 ±.005	-.018 ±.008
5882	5	49	8	12.5	+.010	-.008	+.018 ±.006	-.001 ±.004
5885	5	49	9	12.4	-.011	-.008	+.022 ±.008	-.006 ±.006
5901	6	56	8	12.1	-.013	-.008	-.007 ±.008	-.007 ±.006
5950	6	53	8	12.4	+.012	-.007	+.001 ±.010	-.007 ±.004
5980	6	56	7	11.7	+.015	-.008	+.034 ±.005	+.023 ±.007
5992	6	53	8	11.7	-.016	-.008	-.062 ±.008	+.001 ±.010
6029	4	51	8	10.7	+.019	-.010	-.037 ±.005	+.003 ±.005
6245	4	45	7	12.4	+.011	-.008	+.003 ±.006	-.010 ±.008
6276	4	54	8	11.9	-.013	-.008	+ 004 ±.008	-.008 ±.007
6428	6	53	8	11.7	+.014	-.009	-.026 ±.005	-.016 ±.005
6539	4	61	8	11.6	+.014	-.010	+.026 ±.006	-.003 ±.005
6605*	4	52	9	11 7	-.016	-.007	+.046 ±.012	+.007 ±.012
6709	4	59	8	1[illegible].4	+.013	-.009	-.002 ±.004	-.028 ±.004
6783	4	53	8	11.9	+.013	-.008	-.004 ±.011	-.029 ±.008
6807	3	61	8	11.7	-.014	-.009	+.048 ±.012	-.016 ±.010
6918	7	56	8	12.2	+.015	-.005	+.009 ±.003	-.008 ±.006
6984	6	56	10	11.6	+.017	-.006	.000 ±.007	+.018 ±.005
7001	4	37	10	11.3	+.013	-.010	+.045 ±.015	-.017 ±.012
7104*	6	53	9	11.9	+.015	-.007	+.030 ±.014	+.043 ±.010
7147	4	34	9	11.8	+.016	-.007	+.019 ±.009	+.002 ±.010
7202	6	52	9	12.2	-.014	-.006	+.018 ±.012	-.015 ±.010
8374	4	31	10	12.7	+.009	-.004	+.024 ±.005	+.003 ±.004
8647	4	44	9	11.5	+.012	-.002	+.017 ±.008	-.013 ±.009
8667	4	63	9	11.1	+.012	-.007	+.002 ±.006	-.029 ±.005
8677*	4	34	5	11.1	+.012	-.004	+.012 ±.007	-.006 ±.008
8704*	4	43	7	11.8	+.011	-.003	-.004 ±.008	+.006 ±.011

PHL	Other	RA (1950) Dec		l_{II}	b_{II}	m_{pg}	B-V	U-B
7		$21^h 24^m.6$	- 0°01'	53°	-34°	13.9	-2	-4
17		28.0	- 3 16	51	-36	13.9	-2	-4
28*	LDS 749 B	29.7	- 0 02	54	-35	14.8	-2	-5
30		30.0	-16 50	35	-43	13.7	-2	-5
35*	L 1002-62	30.9	- 4 46	50	-38	13.9	-2	-5
86		36.8	- 2 42	53	-38	12.9	-1	-4
101		38.8	-21 57	29	-47	14.4	-2	-5
117		41.1	-23 43	27	-48	13.6	-2	-5
120		41.6	-22 00	30	-47	14.3	-2	-5
145*	L 930-80	44.8	- 8 00	48	-42	14.1	-2	-4
174		48.0	-19 56	33	-48	14.1	-2	-4
178		48.4	-21 20	31	-49	12.7	-2	-5
197		51.6	- 6 27	51	-43	13.3	-2	-5
211		52.6	-10 38	46	-45	13.6	-1	-4
282		22 26.2	+ 1 50	68	-45	13.4	-2	-2
287		26.8	-21 06	36	-57	13.0	-2	-5
333		33.6	-23 32	32	-59	14.1	-2	-4
350		35.4	-26 14	28	-60	14.1	-2	-4
364		37.4	- 1 08	67	-49	14.8	-2	-5
367		37.6	+ 1 52	70	-47	15.8	-2	-4
384		40.4	+ 1 36	71	-48	13.8	-3	-5
459*	L 791-40	23 16.9	-17 22	54	-66	14.2	-2	-3
466		17.7	-18 26	51	-67	14.2	-2	-2
523		24.0	-29 11	22	-71	14.2	-1	-4
538*		26.3	-30 03	20	-72	13.1	-2	-5
555		29.2	-29 09	23	-72	13.7	-2	-5
561		31.4	-29 08	23	-73	14.3	-2	-4
562		31.4	-32 23	12	-72	14.3	-2	-5
573		37.6	-29 45	20	-74	14.2	-2	-4
687		0 05.8	-17 51	109	-44	13.7	-2	-6
694		06.3	- 3 01	98	-64	14.0	-2	-2
717		08.8	-12 46	88	-73	14.0	-3	-6
722		09.2	-10 56	92	-71	15.7	-2	-6
778		16.0	-10 12	97	-71	15.4	-2	-5
815		41.4	- 1 19	119	-61	16.8	-2	-4
828		44.5	- 3 04	121	-60	16.2	-1	-3
838*	L 1012-16	45.6	- 2 18	121	-60	16.7	-2	-4
860		48.6	- 0 26	123	-62	16.2	-2	-4
867		49.2	-31 00	302	-86	14.8	-2	-5
933		57.6	-31 35	280	-85	16.8	-2	-3
984*	L 580-71	1 03.4	-27 54	223	-87	15.5	-2	-2
1062*	R 548	33.8	-11 34	159	-71	14.0	-2	-2
1342		2 30.6	-20 50	203	-66	13.4	-2	-3
1811		21 52.3	- 9 36	48	-45	14.2	0	-2
1957		22 29.8	- 4 06	62	-50	12.2	-1	-2
2038		38.7	- 2 25	66	-50	13.3	-1	-2
2432		23 41.2	-23 15	44	-74	14.8	-1	-1
2673		0 05.8	- 9 30	91	-69	13.5	-1	-2
2766		11.9	-13 39	89	-74	14.8	-1	-1
2833		15.4	- 5 34	101	-67	13.4	-1	-2

PHL	n_{pl}	ΔE	n_*	m_*	Correction to relative motion μ_α	μ_δ	Absolute μ_α		μ_δ	
7	5	43	6	14.0	+″003	-″005	-″013	±″011	″000	±″010
17	5	44	5	14.3	+.002	-.004	-.012	±.006	-.020	±.006
28*	10	57	7	13.7	+.003	-.005	+.412	±.003	+.052	±.004
30	4	57	6	13.8	+.004	-.005	-.014	±.011	+.015	±.008
35*	4	45	5	13.7	+.003	-.005	+.087	±.012	-.005	±.011
86	5	45	6	13.9	+.003	-.005	+.029	±.004	+.020	±.006
101	4	53	8	14.0	+.004	-.004	+.028	±.004	-.010	±.005
117	4	53	8	14.1	+.004	-.004	+.016	±.003	+.002	±.007
120	4	53	5	14.2	+.004	-.004	-.014	±.011	-.006	±.007
145*	4	49	6	13.5	+.004	-.005	+.234	±.010	-.113	±.005
174	4	51	6	14.8	+.003	-.003	+.021	±.004	+.007	±.003
178	4	47	8	14.0	+.005	-.005	-.017	±.010	-.020	±.012
197	4	48	6	12.9	+.005	-.006	+.019	±.004	+.048	±.010
211	4	49	6	13.2	+.005	-.006	-.001	±.005	-.006	±.010
282	4	45	7	13.3	+.005	-.006	-.006	±.003	+.004	±.003
287	4	53	6	13.0	+.007	-.006	+.040	±.012	-.008	±.006
333	4	53	6	14.1	+.007	-.006	-.028	±.010	+.007	±.006
350	4	49	7	14.3	+.006	-.004	-.010	±.005	-.004	±.005
364	4	42	6	14.7	+.002	-.005	-.005	±.003	-.018	±.004
367	4	45	6	15.5	-.002	-.004	+.006	±.003	-.035	±.005
384	4	45	6	14.2	-.007	-.007	-.016	±.004	-.009	±.004
459*	4	55	6	14.0	-.006	-.005	-.243	±.003	+.016	±.003
466	4	55	6	14.5	-.006	-.005	-.003	±.004	+.006	±.005
523	4	56	7	14.4	+.007	-.004	+.016	±.005	-.028	±.009
538*	4	54	6	14.0	-.008	-.005	-.011	±.011	+.007	±.008
555	4	56	8	14.8	-.007	-.004	-.012	±.004	-.002	±.007
561	4	56	6	14.9	-.007	-.004	-.020	±.004	-.007	±.006
562	4	54	6	13.9	-.009	-.005	-.025	±.005	-.001	±.004
573	4	56	7	15.0	-.007	-.004	+.025	±.008	+.026	±.006
687	4	48	7	13.5	+.005	-.006	-.023	±.003	-.003	±.003
694	4	48	6	13.7	+.007	-.006	.000	±.003	-.001	±.003
717	4	46	6	13.6	-.008	-.006	-.019	±.005	+.011	±.004
722	4	46	6	14.9	+.006	-.005	-.013	±.007	-.017	±.004
778	4	46	7	14.4	-.007	-.005	+.037	±.008	-.051	±.007
815	4	46	6	15.8	-.004	-.004	-.012	±.010	+.021	±.003
828	4	46	7	15.5	-.004	-.005	+.008	±.005	-.016	±.006
838*	4	46	6	16.0	-.004	-.004	+.136	±.004	-.007	±.003
860	4	46	6	15.6	-.004	-.004	-.014	±.004	-.026	±.012
867	5	56	7	14.6	-.007	-.003	-.026	±.007	+.023	±.005
933	5	56	6	16.2	-.006	-.002	-.015	±.006	-.040	±.004
984*	3	25	6	14.3	-.009	-.003	-.305	±.014	-.054	±.014
1062*	4	52	5	13.6	-.010	-.006	-.461	±.006	-.301	±.005
1342	4	52	7	13.4	-.010	-.004	-.010	±.004	-.003	±.004
1811	4	49	8	13.8	-.004	-.005	-.004	±.004	-.008	±.005
1957	4	45	7	12.1	+.008	-.008	-.002	±.007	-.019	±.006
2038	4	42	6	13.8	-.005	-.005	-.008	±.006	-.024	±.007
2432	4	53	5	14.6	-.007	-.004	-.016	±.006	-.012	±.006
2673	4	50	6	14.7	-.006	-.005	-.040	±.010	-.025	±.010
2766	4	46	7	14.5	-.007	-.005	-.017	±.003	-.002	±.003
2833	4	50	7	14.9	+.006	-.005	-.012	±.003	-.009	±.005

PHL	Other	RA (1950) Dec	l_{II}	b_{II}	m_{pg}	B-V	U-B
2865*	F 5	$0^h 17^m.6$ - 3°14'	104°	-65°	14.5	-1	-2
2889		24.4 -13 53	114	-48	14.3	-1	-1
3297		1 01.1 -13 16	128	-49	13.6	-1	-2
4537		21 27.4 - 3 17	50	-36	13.9	0	-1
4882		44.1 -20 47	32	-48	12.5	0	0
4970		50.1 - 6 34	51	-43	14.7	0	0
5120		22 22.4 - 2 59	61	-47	14.1	0	0
5131		23.2 -29 36	20	-58	14.4	0	0
5134		23.2 - 1 19	64	-46	14.4	0	0
5147		24.1 - 2 38	68	-44	14.4	0	0
5248		29.0 - 2 45	63	-48	14.7	0	0
5252		29.2 - 0 41	66	-47	14.0	0	0
5267		29.8 -20 36	37	-58	12.7	0	0
5293		31.6 -26 30	27	-60	14.1	0	0
5314		32.4 - 4 43	62	-50	14.7	0	-1
5412		39.6 - 2 24	66	-50	14.5	0	0
5430		41.2 - 0 38	69	-49	13.4	0	0
5801		23 22.9 -30 32	18	-71	13.0	0	-1
5951		31.1 -24 04	39	-72	14.1	0	0
6012		37.7 -27 23	29	-74	14.1	0	0
6027		39.9 -21 21	50	-73	14.2	0	-1
6285		0 04.3 -13 07	85	-72	14.0	0	0
6303		05.4 -10 11	90	-70	14.8	0	0
6307		05.6 - 8 46	92	-69	13.5	0	-1
6379		09.2 -11 29	91	-72	13.8	0	0
6468		14.3 -12 00	94	-73	14.4	0	0
6520		17.6 - 9 54	99	-71	13.6	0	0
6531		25.2 -13 34	114	-49	16.0	0	-1
6581		42.5 -10 17	120	-52	13.8	0	0
6772		49.3 -32 10	302	-85	13.8	0	0
6855		51.9 -14 57	124	-48	13.7	0	-1
6901		53.3 -16 53	128	-79	13.8	0	-1
6962		55.9 -12 54	126	-50	14.5	0	0
7081		1 00.8 -30 00	259	-86	12.0	0	-1
7133		02.8 -15 34	128	-47	14.2	0	-1
7247		29.2 -13 17	159	-73	14.5	0	-1
7252		29.3 -10 20	154	-70	13.0	0	0
7345		32.0 -13 25	161	-73	14.5	0	-1
7415		34.3 -13 46	163	-73	13.6	0	-1
7746		42.8 -13 36	168	-71	13.7	0	0
8278		2 26.2 -21 46	204	-67	14.1	0	0
8364		31.6 -24 22	211	-67	14.4	0	0
8484		39.1 -22 08	207	-64	13.8	0	0
8686*		3 27.0 -27 31	223	-55	13.8	0	0

PHL	n_{pl}	E	n_*	m_*	Correction to relative motion μ_α	μ_δ	Absolute μ_α		μ_δ	
2865*	4	45	6	13.8	-.007	-.006	-.006	±.005	-.033	±.005
2889	4	51	6	14.2	-.005	-.006	-.006	±.005	-.006	±.004
3297	4	48	6	14.8	-.005	-.005	-.028	±.004	-.012	±.006
4537	5	44	5	13.8	-.003	-.005	.000	±.004	-.013	±.006
4882	4	47	6	13.5	-.006	-.006	-.017	±.007	-.016	±.005
4970	4	48	6	14.3	-.003	-.005	-.009	±.004	-.004	±.005
5120	3	45	5	13.8	-.004	-.005	-.011	±.008	-.001	±.008
5131	4	49	7	13.8	-.007	-.005	-.031	±.004	-.003	±.004
5134	3	42	5	14.1	-.004	-.005	-.022	±.008	-.003	±.012
5147	4	45	5	14.5	-.003	-.004	-.003	±.003	-.020	±.005
5248	4	45	5	14.3	-.004	-.005	-.021	±.005	-.005	±.004
5252	4	42	5	13.4	+.005	-.006	-.005	±.008	-.002	±.006
5267	4	53	6	13.5	-.007	-.006	-.035	±.004	-.008	±.005
5293	4	49	7	14.3	-.006	-.004	-.039	±.005	-.016	±.004
5314	4	45	5	14.5	-.004	-.005	-.028	±.007	-.001	±.004
5412	4	42	5	13.8	-.005	-.005	-.011	±.004	-.017	±.006
5430	4	44	5	13.4	-.005	-.006	-.028	±.020	-.059	±.025
5801	4	54	6	13.0	-.010	-.006	-.007	±.004	-.022	±.004
5951	4	53	6	13.5	-.009	-.006	-.001	±.004	-.021	±.004
6012	4	56	8	14.7	-.007	-.004	-.013	±.007	-.002	±.004
6027	4	53	6	14.0	-.008	-.005	-.006	±.005	-.003	±.004
6285	4	46	6	14.6	-.007	-.005	-.030	±.007	-.019	±.008
6303	4	46	5	14.4	-.007	-.005	.000	±.006	-.014	±.055
6307	4	50	6	14.9	+.006	-.005	-.010	±.003	-.026	±.004
6379	4	46	6	14.7	-.006	-.005	-.007	±.003	-.003	±.003
6468	4	46	7	14.4	-.007	-.005	-.008	±.006	-.005	±.006
6520	4	46	5	14.6	-.006	-.005	-.017	±.005	-.005	±.006
6531	4	51	6	15.6	+.003	-.005	-.038	±.011	-.010	±.008
6581	4	52	6	13.8	-.007	-.007	-.005	±.005	-.033	±.003
6772	5	56	6	13.5	-.011	-.004	-.000	±.005	-.024	±.015
6855	4	48	6	13.9	-.006	-.006	-.006	±.005	-.020	±.006
6901	4	53	6	13.2	-.009	-.006	-.031	±.015	-.001	±.015
6962	4	48	5	14.8	-.005	-.005	-.009	±.004	-.004	±.004
7081	5	56	7	12.7	-.013	-.005	-.001	±.005	-.023	±.007
7133	4	48	6	15.1	-.004	-.005	-.005	±.005	-.015	±.004
7247	4	52	5	14.0	-.009	-.005	-.014	±.005	-.029	±.005
7252	4	52	6	13.4	-.010	-.006	-.007	±.007	-.007	±.007
7345	4	52	6	13.9	-.009	-.005	-.025	±.008	-.028	±.006
7415	4	52	6	13.6	-.010	-.006	-.001	±.004	-.015	±.005
7746	4	52	5	13.9	-.009	-.005	-.005	±.006	-.031	±.005
8278	4	52	6	14.3	-.008	-.003	-.008	±.005	-.009	±.004
8364	4	52	7	14.2	-.006	-.002	-.018	±.010	-.017	±.007
8484	4	52	6	13.6	-.009	-.003	-.029	±.006	-.004	±.004
8686*	16	59	9	14.2	-.007	.000	-.750	±.004	-.375	±.005

NOTES TO THE TABLE

PHL	
25	L 786-65, BPM 81665, 0".088, 198°, possibly an SS Cygni variable.
718	HV 8002, cf. FAC 1574.
1641	This <u>not</u> BD -3: 5255, but 142" in 205° from it.
3802	L 583-35, BPM 47357, 0".13, 146°, possibly an SS Cygni variable.
6605	Perth astrographical Catalogue position discordant.
7104	Yale gives +".033, +".015.
8677	Yale gives +".021, +".032.
8704	Yale gives +".014, +".017.

28	LDS 749 B, LTT 16294, motion taken from Pub. Obs. Minn., III, No. 9, 1961.
35	L 1002-62, BPM 81709, 0".18, 78°.
145	L 930-80, LTT 8702, 0".39, 114°.
459	L 791-40, LTT 9491, 0".26, 80°.
538	Haro-Luyten variable No. 4, cf. P. A. S. P., 71: 470, 1959, possibly an R Cor. Bor. type variable.
838	L 1012-16, BPM 84550, 0".16, 65°.
984	L 580-71, LTT 615, 0".27, 108°.
1062	R 548, L 798-11, LTT 873, 0".44, 99°.
2865	Feige 5.
8686	L 587-77, motion taken from Pub. Obs. Minn. III, No. 9, 1961.

for variability. Star PHL 1126 (Co -24: 731) might be a low-tangential velocity star similar to CPD -69: 177, or a high velocity horizontal-branch object. It is gratifying to find that all stars fainter than 12.5 with motions larger than 0".05 were found in the original Bruce Proper Motion Survey and their BPM numbers are given in the notes.

We are indebted to Diane Schneider for identifying the first 54 stars in the Astrographic Catalogue and for plotting the identification charts, to Norman Evensen for measuring the motions of 26 stars and to the Office of Naval Research for a substantial grant which made this research — and its publication — possibile.

Minneapolis, Minnesota
23 May 1963

A SEARCH FOR FAINT BLUE STARS.

XXXIV. PROPER MOTIONS FOR 24 FAINT BLUE STARS IN ORION.

by Willem J. Luyten and Helen S. Hughes

In two previous papers in this series — XIX and XXVIII — data have been given on some faint blue stars in three fields in the general vicinity of the Orion Nebula. Two of these contain considerable obscuration, the third was used as a control. Blue or white stars seen against a background of obscuration are likely to be white dwarfs, and this should be verifiable by determining their proper motions. Unfortunately in this case the distance of the Orion Nebula — and presumably therefore, also of the obscuring clouds — is some 500 to 600 parsecs, such that, considering also the nearness to the solar antapex, stars lying just in front of it could not be expected to show motions much larger than 0".010 annually. Judging the situation from another angle, we might say that, since white dwarfs found in proper motion surveys generally have a mean value of $H = m + 5 + 5 \log \mu$ of about 16, any white dwarfs in the Orion region might be expected to have values of H around 15.5, thus leading to motions of the order of 0".08 annually for $m = 16$, and of 0".02 for $m = 19$. Yet, if any "infra-dwarfs" similar to LP 327-186 with $H = 21.5$ were present among these stars we might find some large motions, even among stars of the 19th and 20th magnitude.

For these reasons we decided to try and measure the motions of some of the bluest stars in the Orion region. The available plate material consisted of two early plates taken with the Harvard 24-inch Bruce telescope in November 1901 and November 1929, respectively, for the loan of which we are indebted to D. H. Menzel, director of the Harvard Observatory. For the new plates we had a duplicate negative, on glass, of the earliest Palomar Survey plate centered at 5:36 -6 (1855) taken in March 1950, and a repeat of it, taken in November 1958, thus giving us a maximum interval of 57 years. In addition to this we also obtained the loan of an original 48-inch Schmidt plate taken in December 1951, and centered on the Orion Nebula, and a repeat of it, taken in February 1963.

Measures made on the first four plates were reduced together and values for the proper motions derived from them but separate measures and reductions were made on the Palomar originals, to obtain an entirely independent check on the motions. The data obtained in this way are shown in Table I where the first five columns require no further explanation. Columns 6 and 7 give the values for the components of proper motion as determined from the Harvard-Palomar duplicates combination, while columns 8 and 9 show the similar data obtained from the two Palomar originals. The last two columns give the adopted averages.

From the internal discordances we estimate that the mean error of a single component of proper motion is ±0".027 for the Harvard-Palomar combination, while, with an interval of 11+ years for the Palomar originals, which means that a displacement of 1 micron corresponds to a motion of 0".006 annually, we estimate that the mean errors of the components of motion average about ±0".015. Accordingly weights of about 1 and 3 were used in making up the averages adopted.

All motions are relative to from 4-6 comparison stars of roughly the same magnitude as the star concerned. The vexing question of the corrections to be applied to convert these into absolute motions is difficult to resolve at present, especially for stars lying in front of an obscuring cloud, but it would seem to us that for stars of this faintness these corrections would not be more than about +0".007 and -0".007, respectively, or much smaller than the accidental errors of measurement.

The only stars for which the motions appear definite enough to suggest they are white dwarfs are LB 5101, 5103, 5107, all in the control area, and 5120 and 5122 near the Orion Nebula. LB 5102, 3532, 5131, and LP 658-B 127 and possibly even LB 5106 and 5127 may likewise turn out to be white dwarfs, but further confirmation of their motions, or spectra would be necessary before we could be certain.

The most puzzling of these stars are perhaps LB 3520 — which is seen against one of the blackest portions of the Horsehead Nebula — and LB 5116/5125, the brightest two, none of them showing much measurable motion though it would be especially expected for them.

We are indebted to the Office of Naval Research for a contract which made this research possible.

Minneapolis, Minnesota
8 June 1963

Table I

LB	RA 1950 Dec	m_{pg}	I. C.	μ_α	μ_δ	μ_α	μ_δ	μ_α	μ_δ
5101	$5^h22^m.6$ -3°49'	17.0	-0.2	-″090	+″045	-″039	″000	-″052	+″011
5102	23.4 -3 14	19.0	0.0			+.018	-.048	+.018	-.048
5103	23.6 -3 42	18.6	-0.1			+.078	.000	+.078	.000
5104	24.0 -4 15	19.2	-0.1			+.015	-.024	+.015	-.024
5106	26.3 -3 29	18.0	-0.2			+.030	+.020	+.030	+.020
5107	26.8 -3 56	17.0	-0.3	-.063	-.090	-.060	-.060	-.061	-.068
5151	26.9 -2 58	20.6	0.0			-.006	+.006	-.006	+.006
5109	30.7 -7 24	17.0	-0.2	+.006	+.010	-.006	+.036	-.003	+.030
5222	31.4 -7 38	16.4	+0.1	-.007	-.022	.000	.000	-.002	-.006
5116	32.0 -7 14	14.7	0.0	+.018	-.021	+.018	.000	+.018	-.006
5120	32.5 -6 45	16.9	-0.3			+.012	-.060	-.012	-.060
5121	32.5 -7 31	17.7	0.0	+.053	+.005	-.018	-.006	+.002	-.003
5122	32.6 -7 29	16.7	-0.3	+.030	-.008	+.042	+.006	+.039	+.002
5125	37.1 -6 07	15.2	-0.1	-.017	+.010	+.024	+.012	-.013	+.011
5126	38.4 -6 23	16.8	-0.4	-.018	-.002	.000	-.006	-.005	+.004
3520	38.9 -2 22	17.4	0.0	+.007	-.020	-.024	+.024	-.016	+.015
5127	38.9 -5 45	16.4	-0.1	+.007	-.037	-.018	+.048	-.012	+.044
5128	39.0 -5 47	15.7	-0.1	+.010	+.018	.000	.000	+.003	-.005
5129	39.6 -8 16	18.5	-0.1			.000	+.018	.000	-.018
3532	41.7 -2 31	19.3	-0.4			-.006	-.030	-.006	-.030
5131	41.7 -8 12	17.8	0.0			-.015	-.042	-.015	-.042
5132	42.5 -7 24	16.5	-0.1			+.024	-.030	+.024	-.030
5133	42.8 -6 38	16.1	-0.1	+.009	-.006	-.036	-.030	-.024	+.020
LP 658- -B 127	43.2 -7 12	16.2	-0.1	+.005	-.038	+.054	-.030	+.042	-.032